

# 2946A Avionics Communications Service Monitor

Communication and ramp testing of military and commercial aircraft in one instrument



- **Comprehensive Radio Communication Test Set**
- **Full span spectrum analyzer with offset tracking generator**
- **Avionics modes for ILS, VOR, marker beacons and SELCAL**
- **Displays in avionics terms: SDM, DDM, Bearing and TO and FROM**
- **Extensive pre-sets for avionics functions DDM and Bearing**
- **Auto-increment of VOR Bearing for aircraft display testing**
- **DC operation from aircraft power supplies or internal batteries**
- **Avionics testing in both Direct and 'Off Air' configurations**

*IFR is a leader in the design, manufacture and marketing of Avionics test systems.*

*The 2946A Communications Service Monitor is the lightest, most rugged service monitor available with a full performance spectrum analyzer as standard. For field work, the 2946A provides an excellent combination of instruments for all types of maintenance work. In the workshop, it provides all of the performance you would expect for exacting measurements.*

## [Avionics Systems Test Facility](#)

The 2946A provides an impressive range of features for the aircraft and avionics maintenance industry.

In addition to the features provided by the general purpose 2945A, the dedicated 2946A Avionics Communications Service Monitor provides signals for testing the following: ILS receivers for localizer, including identification, glidescope and markers; VOR beacon receivers, with identification; SELCAL

selective calling receivers.

The 2946A screen gives a representation of the aircraft's display in each mode, with the effective test signal parameters clearly indicated both diagrammatically and numerically. Parameters can be altered in steps or continuously.

### Field Operation

At under 12 kg (26 lbs.), the 2946A lightens the load to remote sites. The shape of the 2946A is ideal for carrying. The side handle ensures that the instrument is clear of the stairs when ascending buildings and the depth is suitable for the 2946A to be operated comfortably when placed on the floor. An optional bail arm is also available. This option allows a stowage cover to be fitted over the front panel for storage of adapters and further protection to the instrument's front panel. Full operation is possible from the protective "ever-ready" case so that your investment is protected from transit damage.

### Battery - carry a spare

The battery fits neatly into the "ever-ready" case and is easily replaced with a spare when discharged. There is no memory effect associated with the battery, even when partially discharged.

### Fast Warm Up - fast results

The standard TCXO allows results to be made reliably within a minute of switch-on. (Where even better stability is required, an optional OCXO is available.)

Stored settings may be recalled from internal memory or from a memory card, allowing fast and straightforward setup.

### Accurate RF Signals

The signal generator provides coverage from 400 kHz to 1.05 GHz with +5 dBm output (+7 dBm overrange) and fast switching speed. Level accuracy is  $\pm 2$  dB at all levels above -127 dBm.

### Duplex - provided as standard

Full duplex operation is provided by the 2946A. This allows testing of duplex radios as well as simultaneous testing of repeater transmit and receive paths. There are no restrictions to the duplex offset.

### Cellular and Trunking - built in

AMPS, TACS and NMT analog cellular standards are available internally, with all country variants provided in each package. MPT 1327/1343 trunking system and variants of it are also available.

A new trunking capability has been added with the introduction of EDACS Radio and Repeater test capability.

Remote control of the inbuilt tests is provided, so that measurements can be started and results logged automatically.

### Network Simulation

The 2946A simulates the signaling protocol that the radio would see from the real network. This allows calls to be set up and handled enabling receiver and transmitter parametric measurements to be made.

### Fast Full Performance Spectrum Analyzer - provided as standard

The spectrum analyzer provides spans from 100 Hz per division to full span and also has a fully adjustable reference level. Speed is comparable with analog analyzers, allowing real time adjustments over a full 80 dB dynamic range. With the tracking generator provided as standard, duplexers and filters can be aligned quickly and easily. An offset facility provides testing of equipment with frequency translation. Channel stepping can be performed by defining an increment and then using the FREQ  $\square\square$  keys. This is particularly useful when testing multi-channel systems.

### Live Look and Listen

This feature puts the 2946A above all of its peers with the ability to examine signals on the screen and demodulate them simultaneously. Intermittent interference can be isolated quickly and the signals then easily identified. The trace can be saved to memory card along with the time and date, providing factual evidence that can be recalled later. This feature is particularly useful when looking for rogue transmissions, especially on busy base station sites.

#### From 2 $\mu$ V to 150 W

The 2946A measures the power of low level signals such as those encountered when monitoring off-air signals or those found when probing a circuit. 150 W measurement is provided without the need for external attenuators, so high power base stations can be measured directly. Measurement accuracy of better than 10% is guaranteed all the way down to 5 mW on the N-Type connector, allowing cellular radios to be qualified at low power levels.

#### Remote Control - RS-232 or GPIB

Remote control is provided with an RS-232 interface as standard. An IEEE488.2 interface (Option 5) can be fitted where other instruments are required to operate in a system with the 2946A.

#### Printing Made Easy

With the parallel printer port interface, screen dumps, automatic test results or previously stored results may be sent to any parallel printer. These facilities are available as standard using the serial RS-232 interface.

#### Autorun - internal control

With the (optional) Analog Systems Card fitted, automatic testing without an Ideal external controller is possible. Custom tests may be written and run by the operator. Four programmable relay contacts are provided with the optional parallel printer interface to allow remote control of radios or test fixtures from built-in automatic tests.

#### Custom Programs

Users may program the instrument to suit their own specific needs.

This is possible either by configuring any of the 4 built-in programs or by using the MIBASIC interpreter to produce a customized test program that can be executed internally, without an external controller.

#### Memory Card - with real time clock

The Memory Card Drive meets the PCMCIA standard format for PC cards. The 2945A provides a DOS based filing system that allows transfer of information to a PC fitted with a memory card slot. Test setups, test results, screen dumps, spectrum analyzer coordinates and test sequences can all be stored on the memory card, allowing information to be easily stored and retrieved when required.

#### Reliability

The 2946A features high integration and a rugged chassis design to maximize mechanical protection.

#### Audio Analysis

A comprehensive range of filters are provided as standard, including bandpass, low-pass and high-pass. Optional filters are available for psophometric weighting of audio signals and demodulation of signals in a simulated radio channel bandwidth.

The direct measurement of CTCSS is possible with the 300 Hz LP filter, even with speech present.  
Two comprehensive audio generators are provided as standard for internal modulation or audio sources for transmitter stimulus.  
External DC coupled FM is provided.

### Comprehensive Oscilloscope

Analysis of audio signals, whether from the demodulated signal or the audio input direct, can be viewed for further inspection. The oscilloscope can either be combined with the measurement screen in the Tx, Rx or AF test modes or 'zoomed' to a full screen display. Different levels of persistence can be selected to allow short or long term effects to be captured.

### Transient Analysis

The ability to capture transients on the rising or falling edge of a waveform provides a valuable tool for fault finding radios and radio systems. The user has full control of the trigger level and input attenuation as well as the timebase and five fixed trigger points, making this feature simple and flexible to operate.

### Harmonic Analysis

An automatic harmonic analysis function is included in the 2946A. This complements the fast spectrum analyzer and allows a rapid check that the transmitter is not producing any large harmonics.

### Tones Generation and Decoding

The tones menus now include full remote control so that radio workshops can further automate their tasks. These and other improvements are in response to user feedback and allow better control of the tones from the top level screens.

### POCSAG Decode - built in option

Off-air decoding of POCSAG signals is provided as an option. This allows tone, numeric and alphanumeric signals to be displayed. Signals with bit rates of up to 4800 bits/s can be automatically detected making the 2946A an ideal surveillance tool. The 2946A can be set to detect all messages, a user selectable RIC (just like a Pager) or a fixed message string.

## Specification

### **Avionics Systems**

*The Avionics feature provides amplitude modulated signals suitable for testing of Instrument Landing Systems (ILS) and VHF Omnidirectional Radio Range (VOR) receivers.*

#### **ILS MODE**

##### **Sum of Depth of Modulation (SDM)**

*0% to 90% glideslope, 0% to 50% localizer in 0.1% steps representing the arithmetic sum of each tone depth*

##### **Selection**

*Keyboard entry*

##### **Accuracy of SDM**

*±5% of setting for carrier frequencies up to 400 MHz*

##### **Difference of Depth of Modulation (DDM)**

*0% to 45% glideslope, 0% to 25% localiser in 0.1% steps limited by SDM*

##### **Selection**

*Keyboard entry and variation of rotary control*

##### **Localiser Presets**

*0%, 4.6%, 9.3% and 15.5% DDM*

##### **Data Entry**

*By table selection of 2 pairs of characters labeled 'A' to 'S'*

##### **Timing**

1 s tone duration, 250 ms gap

#### **MARKER BEACON MODE**

Provides default modulation of 95% AM depth on a 75 MHz carrier at the rate of 400 Hz (outer beacon), 1.3 kHz (middle beacon) or 3 kHz (inner beacon). AM depth, carrier frequency and modulation frequencies can be changed from default values.

#### **RF Signal Generator**

##### **FREQUENCY**

###### **Frequency Range**

400 kHz to 1.05 GHz

###### **Resolution**

10 Hz

###### **Indication**

10 digit display

###### **Setting**

Keyboard entry, delta increment/decrement function and rotary control

###### **Accuracy**

As frequency standard

##### **OUTPUT LEVEL**

###### **Output Level Range**

Rx Test:

N-Type socket: -141 to -21 dBm

BNC socket: -115 to +5 dBm (overrange to +7 dBm)

##### **Glideslope Presets**

0%, 4.5%, 9.1% and 17.5% DDM

##### **Accuracy of DDM**

0.001 DDM (20% depth) at 0 dBm

##### **Tone Frequencies**

90 Hz and 150 Hz (either tone can be suppressed)

##### **Additional Modulation**

1020 Hz ident signal available on 0 DDM on ILS from an internal modulation source

##### **VOR MODE**

9.96 kHz Sub-Carrier Range

0.0% - 99.0% in 0.1% steps

##### **Modulation**

FM by a 30 Hz tone with 480 Hz deviation

##### **30 Hz Tone Range**

0.0% to 99.0% in 0.1% steps

##### **Bearing Control**

Relative phase of the 30 Hz tone and sub-carrier modulation adjustable from 0 to 360° in 0.1° steps by entering VOR bearing.

Bearing can be entered as TO or FROM the beacon.

##### **Automatic VOR Test**

Bearing automatically increments in 0.1° steps

##### **Bearing Accuracy**

±0.5°

##### **Additional Modulation**

Ident signal (1020 Hz) available on 0° bearing from an internal Source

##### **SELCAL MODE**

Provides amplitude modulation with SELCAL tones

Overload indicated by audible and visual warning.

BNC: 5 W Overload indicated by audible and visual warning.

##### **Resolution**

0.1 dB

##### **Indication**

4 digits plus sign (dBm, dBμV, μV, mV PD/EMF)

##### **Accuracy**

±2 dB for level above -127 dBm on N-Type socket up to 1 GHz

##### **Reverse Power Protection**

N-Type: 50 W continuous, normal operation. 150 W for 1 minute at 20°C

##### **Output Impedance**

Nominally 50  $\Lambda$

#### **VSWR**

##### **N-Type**

Better than 1.2:1 up to 500 MHz

Better than 1.35:1 up to 1.05 GHz

##### **BNC**

Better than 2.2:1 up to 1.05 GHz

#### **SPECTRAL PURITY**

(If you require even better spectral purity than that specified here, please consider the 2948.)

##### **Residual FM**

<15 Hz RMS (0.3 to 3.4 kHz) up to 500 MHz

<20 Hz RMS (0.3 to 3.4 kHz) up to 1.0 GHz (with OCXO)

##### **Harmonics**

Better than -20 dBc

##### **Spurious Signals**

Better than -30 dBc ( $\pm 10$  kHz to 1.5 MHz offset from carrier frequency or over range 600 to 700 MHz).

Better than -40 dBc from 400 kHz to 1 GHz.

##### **SSB Phase Noise (20 kHz offset)**

Better than -95 dBc/Hz up to 1 GHz

##### **RF Carrier Leakage**

Less than 0.5  $\mu$ V PD generated in a 50  $\Lambda$  load by a 2 turn loop 25 mm from the case. Output level <-40 dBm into a sealed 50  $\Lambda$  load.

#### **AMPLITUDE MODULATION - INTERNAL**

##### **Frequency Range**

400 kHz to 1.05 GHz

##### **AM Depth Range**

0% to 99%

##### **Resolution**

1%

##### **Indication**

2 digits

##### **Setting**

Keyboard entry, delta increment / decrement function and rotary control

##### **Accuracy**

For carrier frequencies from 1.5 to 400 MHz

$\pm 7\% \pm 1$  digit for modulation frequency of 1 kHz

$\pm 10\% \pm 1$  digit for modulation frequencies from 50 Hz to 5 kHz

$\pm 15\% \pm 1$  digit for modulation frequencies from 50 Hz to 15 kHz

##### **Distortion**

<2% at 1 kHz for 30% AM, CCITT weighted

##### **Modulation Frequency**

20 Hz to 20 kHz

#### **AMPLITUDE MODULATION - EXTERNAL**

##### **Input Impedance**

Nominally 10 k $\Lambda$  in parallel with 40 pF

##### **Frequency Range**

As internal AM

##### **Modulation Frequency Range**

As internal AM

##### **Sensitivity**

1 V RMS for 100% AM

#### **FREQUENCY MODULATION - INTERNAL**

##### **Frequency Range**

400 kHz to 1.05 GHz

##### **Maximum Deviation**

75 kHz

##### **Indication**

3 digits

##### **Setting**

Keyboard entry, delta increment/decrement function and rotary control

##### **Accuracy (1)**

$\pm 5\% \pm 10$  Hz at 1 kHz modulating frequency

$\pm 10\%$  at modulating frequencies from 50 Hz to 15 kHz

### **Distortion**

<1% at 1 kHz for deviation of 5 kHz, CCITT weighted

### **Modulation Frequency Range**

20 Hz to 25 kHz

### **Resolution**

25 Hz

### **Pre-emphasis**

750  $\mu$ s selectable

## **FREQUENCY MODULATION - EXTERNAL**

### **Input Impedance**

Nominally 10 k $\Omega$  in parallel with 40 pF

### **Frequency Range**

As internal FM

### **Modulation Frequency Range**

DC to 100 kHz

### **Pre-emphasis**

750  $\mu$ s selectable

### **Sensitivity**

1 V RMS for 0 to 75 kHz deviation

## **MICROPHONE INPUT**

### **Input Level**

2 to 200 mV (AGC levelled)

### **Input Impedance**

Nominally 150  $\Omega$

### **Press To Talk (PTT)**

When using the optional microphone in Tx Test mode, the PTT will switch instrument to Rx Test.

## **Audio Voltmeter**

### **Input Impedance**

Nominally 1 M $\Omega$  in parallel with 40 pF

### **Frequency Range**

DC and 20 Hz to 50 kHz

AC only 20 Hz to 50 kHz

### **Level Ranges**

0 to 100 mV to 0 to 100 V RMS in a 1, 3, 10 sequence

Digital readout also in mW (user selectable)

### **Maximum input voltage**

30 VRMS, 50 Vdc

### **Resolution**

1 mV or 1% of reading

### **Indication**

3 digits and bar-chart

### **Accuracy**

$\pm 3\% \pm 3$  mV  $\pm$  resolution

## **Audio Frequency Meter**

### **Frequency Range**

20 Hz to 20 kHz

### **Resolution**

0.1 Hz, <10 kHz

1 Hz, at 10 kHz and above

### **Indication**

5 digits

### **Accuracy**

As frequency standard  $\pm 1$  digit  $\pm$  resolution

### **Sensitivity**

50 mV

## **Audio Sinad Meter**

### **Frequency**

1 kHz

### **Range**

0 to 18 dB and 0 to 50 dB

### **Resolution**

0.1 dB

### **Indication**

3 digits and bar-charts

### **Accuracy**

$\pm 1$  dB

### **Sensitivity**

50 mV (100 mV for 40 dB SINAD) reading suppressed if audio voltage is less than 5 mV

### **Audio Distortion Meter**

#### **Frequency**

1 kHz

#### **Range**

0% to 10%, 0% to 30% and 0% to 100%

#### **Resolution**

0.1% distortion

#### **Indication**

3 digits and bar-charts

#### **Accuracy**

±5% of reading ±0.5% distortion

#### **Sensitivity**

50 mV (100 mV for 1% distortion) reading suppressed if audio voltage is less than 5 mV

### **Audio S/N Meter**

#### **Range**

0 to 30 dB and 0 to 100 dB

#### **Resolution**

0.1 dB

#### **Indication**

3 digits and bar-chart

#### **Accuracy**

±1 dB

#### **Sensitivity**

50 mV (100 mV for 40 dB S/N) reading suppressed if audio voltage is less than 5 mV

### **Audio Oscilloscope**

#### **Operating Modes**

Single repetitive sweep

#### **Frequency Range**

DC to 50 kHz, 3 Hz to 50 kHz AC coupled

#### **Voltage Range**

10 mV to 20 V per division in a 1, 2, 5 sequence

#### **Voltage Accuracy**

±5% of full scale

#### **FM Ranges**

±75, 30, 15, 6, 3 and 1.5 kHz deviation full scale, ±10% accuracy

#### **AM Ranges**

20, 10 and 5% per division, ±10% accuracy

#### **Timebase**

50 ns/div to 5 s/div in a 1, 2, 5 sequence

#### **Graticule**

10 Horizontal by 6 Vertical divisions

#### **Special Features**

Built in anti-aliasing circuitry

### **Audio Bar-Charts**

#### **Bar-Chart Displays**

AF Voltage, SINAD, Distortion, S/N

#### **Vertical Resolution**

2% of full scale

#### **Ranging**

Autoranging, range hold or manual selection

1, 2, 5, sequence with hysteresis

#### **Audio and Modulation Filters**

300 Hz, 3 kHz, 15 kHz Low-pass

300 Hz to 3.4 kHz Bandpass

300 Hz High-pass

750  $\mu$ s de-emphasis

50 kHz LP (No filter selected)

#### **Audio Analyzer General Features**

Tones Mode

### **RF Frequency Meter**

#### **Frequency Range**

100 kHz to 1.05 GHz (manual tune)

10 MHz to 1 GHz (autotune)

#### **Resolution**

1 Hz or 10 Hz, selectable



### **Indication**

Up to 10 digits

### **Accuracy**

As frequency standard  $\pm$  resolution

### **Acquisition Time**

Less than 1 s (manual)

Typically 3 s (autotune)

### **Sensitivity**

Autotuned: 5 mW (N-Type)

0.05 mW (Antenna port)

Manual Tuned: -34 dBm (N-Type) -60 dBm (Antenna port)

### **VSWR**

N-Type: Better than 1.2:1 up to 500 MHz

Better than 1.25:1 up to 1.0 GHz

BNC: Better than 3:1 up to 1.0 GHz

### **RF Power Meter (broadband)**

#### **Frequency Range**

200 kHz to 1.05 GHz

#### **Dynamic Range**

5 mW to 150 W (N-Type)

0.05 to 250 mW (Antenna port)

#### **Indication Units**

Watts, dBm or dBW

#### **Indication**

3 digits or bar-chart

#### **Resolution**

0.1 dB maximum, typically 1%

#### **Accuracy (N-Type)**

$\pm 10\%$   $\pm$  resolution up to 1 GHz

#### **Maximum Continuous Rating**

N-Type: 50 W at 20°C

Antenna port: 1 W

#### **Intermittent Rating**

N-Type: 150 W for limited periods, typically 1 minute at 20°C.

Overload indicated by audible and visual warning.

### **Harmonic and Transient Analysis**

#### **HARMONIC MEASUREMENT**

Displays 1st to 5th harmonic of the selected carrier

#### **Maximum Harmonic Frequency**

1.05 GHz

#### **Dynamic Range**

0 to -60 dBc

### **TRANSIENT POWER ANALYSIS**

Displays power profile against time

#### **Frequency Range**

1 to 1050 MHz

#### **Dynamic Range**

60 dB below spectrum analyzer reference level

#### **Scale (power)**

10 dB/div

#### **Scale (time)**

50  $\mu$ s/division to 5 s/div

#### **Trigger Level**

Adjustable over full dynamic range +ve or -ve trigger selection

#### **Pre-trigger**

0%, 25%, 50%, 75% or 100% of displayed period

### **Modulation Meter**

#### **Sensitivity**

Autotuned: 5 mW (N-Type)

0.05 mW (Antenna port)

Manual Tuned: -34 dBm (N-Type)

-60 dBm (Antenna port)

#### **Audio & Modulation Filters**

300 Hz, 3 kHz, 15 kHz Low-pass

300 Hz to 3.4 kHz Bandpass

300 Hz High-pass

750  $\mu$ s de-emphasis

50 kHz LP (No filter selected)

### **AMPLITUDE MODULATION**

#### **Frequency Range**

100 kHz to 1.05 GHz

**Modulation Frequency Range**

10 Hz to 15 kHz

**AM Depth Range**

0% to 99% (manually tuned)

0% to 90% below 100 MHz

0% to 80% from 100 to 400 MHz

**Resolution**

1% AM

**Indication**

2 digits and bar-chart

**Accuracy <sup>(1)</sup>**

±5% ±1 digit at 1 kHz

±8.5% ±1 digit from 50 Hz to 10 kHz

**Demodulation Distortion <sup>(1)</sup>**

<2%, at 1 kHz and 30% AM (CCITT weighted)

**Residual AM**

<1% (300 Hz to 3.4 kHz)

**Demodulation Output**

50 mVp-p for 1% AM

**FREQUENCY MODULATION**

**Frequency Range**

100 kHz to 1.05 GHz

**Modulation Frequency Range**

10 Hz to 15 kHz

**Deviation Range**

0 to 75 kHz

**Resolution**

10 Hz below 2 kHz deviation

1% above 2 kHz deviation

**Indication**

3 digits and bar-chart

**Accuracy <sup>(1)</sup>**

±5% ±resolution at 1 kHz modulation frequency

±7.5% ±1 digit for modulation frequencies 50 Hz to 10 kHz

**Demodulation Distortion**

<2% at 1 and 5 kHz FM (CCITT weighted)

**Residual FM**

<30 Hz (300 Hz to 3.4 kHz)

**Demodulation Output Socket**

200 mVp-p ±10% per 1 kHz deviation

**RF Spectrum Analyzer**

**Frequency Range**

100 kHz to 1.0 GHz

**Spans**

1 kHz/div to 100 MHz/div in a 1, 2, 5 sequence or continuously variable

Start - stop facility allows selection of infinitely variable span width

**Resolution Bandwidth**

300 Hz, 3 kHz, 30 kHz, 300 kHz, 3 MHz

**Reference Level (top of screen)**

-50 to +52 dBm 0.7 mV to 71 V

**On Screen Dynamic Range**

80 dB

**On Screen Linearity**

Typically ±2 dB ±1 resolution (10 dB/div) >10 dB above noise floor

**Vertical Resolution**

0.1 dB on 2 dB/div

0.5 dB on 10 dB/div

**Level Flatness**

±1 dB ±resolution over 50 MHz span

**Intermodulation Distortion**

Better than 70 dB for two signals at -30 dBm into first mixer

**Sweep Speeds**

10 ms/div to 200 ms/div in a 1, 2, 5 sequence (optimum sweep speed and bandwidth selected according to span or user selectable)

**Span Resolution Update**

**Bandwidth (Sweeps/sec)**

10 kHz 300 Hz 5

100 kHz 3 kHz 9

1 MHz 30 kHz 9  
10 MHz 300 kHz 9  
100 MHz 300 kHz 5  
1000 MHz 3 MHz 5

#### **Marker Indication**

Level and frequency or delta marker from center line of screen  
Single marker for frequency and level display  
Marker to center frequency

⊗ marker

#### **Features**

Simultaneous 'Look and Listen' spans 100 kHz, 200 kHz, 500 kHz,  
1 MHz  
Start/stop frequency entry

#### **Sensitivity**

2  $\mu$ V

#### **Tracking Generator Offset**

0 to 999 MHz

#### **Audio Generators**

##### **FREQUENCY**

##### **Frequency Range**

10 Hz to 25 kHz (sine or square)

##### **Setting**

Keyboard entry, delta increment/decrement function and rotary control

##### **Indication**

5 digits

##### **Resolution**

0.1 Hz below 3.25 kHz

1 Hz above 3.25 kHz

##### **Accuracy**

0.01 Hz below 180 Hz

0.1 Hz above 180 Hz

##### **LEVEL**

##### **Level Range**

0.1 mV to 4 V RMS

##### **Setting**

Keyboard entry, delta increment/decrement function and rotary control

##### **Indication**

4 digits

##### **Resolution**

0.1 mV below 409 mV

1 mV above 409 mV

##### **Accuracy**

$\pm 5\%$  +resolution 50 Hz to 15 kHz

##### **Output Impedance**

Nominally 5  $\Omega$  (minimum load 25  $\Omega$ )

##### **Distortion**

<0.5% at 1 kHz

<1% from 50 Hz to 15 kHz

##### **Signaling Encoder/Decoder**

Sequential tones functions including revert

User defined tones

Encodes and decodes up to 40 tones

CCIR, ZVEI, DZVEI, EEA, EIA or user defined

Any of the tones may be extended

Continuous, burst and single step modes available

Up to two frequency plans may be defined and stored within the 2945A for sequential tones.

Any of the standard tone frequency plans may be copied to user defined and modified.

Tone length 20 ms to 1 s

Standard tone frequencies may be selected from a menu.

Generation and decoding of DTMF tones

Generation and decoding of DCS (Digitally Coded Squelch)

Generation of POCSAG code CCIR No.1 Rec 584

Bit rates from 400 to 4800 bit/s.

Inversion available

##### **AUDIO MONITOR**

Demodulated signals and audio signals may be monitored via the

internal loudspeaker and the accessory socket output on the front panel.

## **Cellular and Trunking**

### **Test Modes**

Auto test/manual test

### **Auto Test Programs**

Call processing only

Call and RF testing

Brief testing

Comprehensive testing

### **Parametric Auto Test Routines**

AF Frequency AF Level

FM Deviation Mod Frequency

Rx Distortion Rx Expansion

Rx Sensitivity Rx SINAD

Rx S/N Tx Compression

Tx Distortion Tx Frequency

Tx Level Tx Power Level

Tx Limiting Tx Mod Level

Tx Noise Tx SINAD

Tx S/N

### **Signaling Auto Test Routines**

Registration/Roaming Update

Place Call

Page Mobile

Clear from Land

Clear from Mobile

Handoff

Hook Flash

DTMF Decode

Data Performance

PTT On

PTT Off

SAT Deviation

SAT Frequency

ST Duration

ST Frequency

ST Deviation

DSAT Deviation

## **Frequency Standard**

### **Internal Frequency Standard (TCXO)**

#### **Frequency**

10 MHz

#### **Temperature Stability**

0.5 ppm, 0° to 40°C

0.6 ppm 0° to 50°C

#### **Ageing Rate**

Better than 1 ppm per year

#### **Warm up**

1 minute to specified accuracy

### **External Frequency Standard Input**

#### **Frequency**

1, 2, 5 and 10 MHz

#### **Input Level**

Greater than 1 Vp-p

#### **Input Impedance**

Nominally 1 k $\Omega$

## **General**

### **Keyboard and Display**

Logical color coded keyboard with bright high resolution fast LCD

### **Display Size**

160 x 85 mm

### **RS-232C**

RS-232C interface is provided for printing and remote instrument control

### **Connector**

9 way female "D" Type

## **POWER REQUIREMENTS**

### **AC Supply Voltage**

90 to 265 V

#### **AC Supply Frequency**

90 to 264 V 45 Hz to 67 Hz

90 to 132 V 45 Hz to 440 Hz

#### **Maximum AC Power**

190 VA

#### **DC Supply Voltage**

11 to 32 V

#### **Maximum DC Power**

100 W

#### **Charge Output**

13.8 V at 6 A maximum to charge a 12 V sealed lead acid battery

#### **CALIBRATION INTERVAL**

2 years

#### **ELECTROMAGNETIC COMPATIBILITY**

Conforms with the protection requirements of the EEC Council directive 89/336/EEC.

Complies with the limits specified in the following standards:

IEC/EN61326-1: 1997, RF Emission Class B, Immunity Table 1, Performance Criteria B

#### **Safety**

Conforms with the requirements of EEC Council Directive 73/23/EEC and Standard IEC/EN 61010-1 : 1993

Complies with IEC 1010-1, BS EN61010-1 for class 1 portable equipment and is for use in a pollution degree 2 environment. The instrument is designed to operate from an installation category 1 or 2 supply.

Approved to UL3111-1

#### **ENVIRONMENTAL**

##### **Rated Range of Use**

0° to 50°C and up to 95% relative humidity at 40°C

##### **Storage and Transport**

###### **Temperature**

-40° to +71°C

###### **Altitude**

Up to 2500 m (pressurized freight at 27 kPa differential)

###### **Dimensions**

178 mm height; 380 mm weight; 457 mm depth (including handle, feet and covers)

7 in. height; 15 in. weight; 18 in. depth (including handle, feet and covers)

###### **Weight**

<11.4 kg (<25 lbs.)

#### **Options and Accessories**

##### **600 ^ MATCHING UNIT (OPTION 1)**

Switchable 600 ^ balanced audio input and output

Switchable 20 dB attenuator on AF generator output

##### **ANALOG SYSTEMS CARD (OPTION 2)**

This option provides automatic testing for cellular, trunked and FM radio's and a BASIC Interpreter for customized tests.

##### **HIGH STABILITY INTERNAL FREQUENCY (OCXO) STANDARD (OPTION 3)**

###### **Frequency**

10 MHz

###### **Temperature Stability**

Better than 0.05 ppm, 5° to 55°C

###### **Ageing Rate**

Better than 0.1 ppm, per year, after 1 month continuous use

###### **Warm-up Time**

<10 minutes to within 0.2 ppm at 20°C

##### **PARALLEL INTERFACE (OPTION 4)**

Allows direct connection of a parallel printer. Provides 4 software programmable output lines

###### **Printer Port**

###### **Connector**

25 way female "D" Type

###### **Printers Supported**

75, 100, 150 dpi laser printers, FX 80, FX 100 Epson format

###### **Accessory Port**

###### **Connector**

9 way female "D" Type

### **Outputs**

4 independently programmable output lines, each one configurable as a logic line or as a relay contact closure, +5 V supply available

### **GPIB (OPTION 5)**

#### **Capability**

For printing, remote instrument control or for programming of user defined test sequences

Complies with the following subsets defined IEEE488:

SH1, AH1, T6, L4, SR1, RL1, DT0, EI, DC1

### **MEMORY CARD DRIVE AND REAL TIME CLOCK (OPTION 6)**

The memory card facility allows the storage of results, setup screen dumps and user programs with SRAM cards. Meets PCMCIA 2 standard

Allows the current date and time to be stored with results to the memory card and/or printed with a screen dump.

### **SSB DEMODULATOR (OPTION 8)**

The SSB demodulator allows signals to be demodulated either via the internal loudspeaker or via the accessory socket. Provides demodulation of SSB signals (upper and lower sideband)

#### **Frequency Range**

400 kHz to 1 GHz

#### **AF Demodulation Range**

10 Hz to 15 kHz

#### **Distortion**

Typically <3% at 1 kHz (300 to 3.4 kHz)

#### **Detection Range**

2  $\mu$ V to 150 W

#### **Features**

Automatic detection of USB or LSB. BFO can be used for tuning of carrier for AM and FM radios.

### **NMT CELLULAR SOFTWARE (OPTION 10)**

NMT 450 NMT 900

Benelux NMTF

Austria Spain

Malaysia Indonesia

Saudi 1 Saudi 2

Thailand Oman

Tunisia Hungary

Poland Russia

Czech Bulgaria

Slovenia Turkey

USER DEFINED NMT

### **AMPS CELLULAR SOFTWARE (OPTION 11)**

USER DEFINED AMPS

### **TACS CELLULAR SOFTWARE (OPTION 12)**

E-TACS TACS 2

C-TACS I C-TACS II

J-TACS N-TACS

USER DEFINED TACS

### **MPT 1327 TRUNKING SOFTWARE (OPTION 13)**

BAND III JRC

UK WATER HONG KONG

AUTONET AMT

MADEIRA NL-TRAXIS

NZ MPT1327 PH-INDO

USER DEFINED MPT

### **PMRTEST SOFTWARE (OPTION 14)**

USER DEFINED PMR for FM radios

### **EDACS RADIO TEST SOFTWARE (OPTION 15)**

Provides Auto/Manual test capability for EDACS<sup>®</sup> radios. Up to 4 user defined variants can be created and stored, each with up to 24 spot channel frequencies.

Performs BER tests to check performance of receiver and transmitter

### **EDACS REPEATER TEST SOFTWARE (OPTION 16)**

Provides Auto/Manual test capability for EDACS<sup>®</sup> repeaters. Up to 4 User defined variants can be created and stored, each with up to 24 spot channel frequencies. A data logging facility is also available to continuously decode and display data messages from the repeater under test.

EDACS is an Ericsson GE registered trademark.

IFR Ltd is an EDACS trunking licensee.

#### **DEMODULATION FILTERS (OPTION 21)**

Provides a range of high selectivity channel filters in Spectrum Analyzer Look and Listen mode. Shape factor approximates to ETSI requirements.

##### **Bandwidths**

5, 12.5, 25, 50 and 300 kHz

#### **POCSAG DECODE (OPTION 22)**

Allows off-air decoding of POCSAG messages. Can decode a message as it is received or decoding can be triggered from a user selectable RIC code or fixed message pattern.

##### **Bit Rate**

Automatically decodes any standard bit rate up to 4800 bits/s.

Numeric or alphanumeric decoding is provided.

Number of received errors is displayed.

#### **CCITT FILTER (OPTION 23)**

Allows a CCITT filter to be inserted into either the demodulated audio path or the audio input path.

#### **CMESS FILTER (OPTION 24)**

Allows a CMESS filter to be inserted into either the demodulated audio path or the audio input path.

#### **BAIL ARM/FRONT COVER (OPTION 30)**

Provides a Bail arm carrying handle and front panel cover and storage area. The Bail arm also provides additional viewing angles when mounted on a bench.

#### **BATTERY PACK**

##### **Type**

12 V Sealed lead-acid

Connector XLR Type

##### **Capacity**

7 AH (30 minutes operation)

##### **Weight**

3 kg (6.6 lbs.)

##### **Charge time from instrument**

16 hours

Certain characteristics are shown as typical. These provide additional information for applying the instrument, but are unwarranted.

## **Versions and Accessories**

When ordering please quote the full ordering number information.

### **Ordering Numbers**

#### **Versions**

2945A Communications Service Monitor

2946A Avionics Service Monitor

2948 Low Phase-Noise Communications Service Monitor

Option 1 600  $\wedge$  Matching Unit

Option 2 Analog Systems Card

Option 3 High Stability OCXO

Option 4 Parallel Interface †

Option 5 GPIB Interface †

Option 6 Memory Card Drive with real time clock

Option 8 SSB demodulator

Note: Option 2 required when ordering any of the following options 10 to 16

Option 10 NMT Cellular

Option 11 AMPS Cellular

Option 12 TACS Cellular

Option 13 MPT 1327 trunking

Option 14 PMRTEST

Option 15 EDACS| Radio Test

Option 16 EDACS| Repeater Test

Option 21 Demodulation Filters

Option 22 POCSAG Decode

Option 23 CCITT Filter †

Option 24 CMESS Filter †

Option 30 Bail Arm and Front Panel Stowage cover

### **Supplied Accessories**

AC Supply lead

DC Supply lead

Operating Manual

#### Optional Accessories

44991/145 Microphone with PTT

59000/189 Memory Card (128 k)

43113/021 Battery Pack for 2945A/2946A ‡

46662/571 'Ever-Ready' Case

46662/616 'Ever-Ready' Case for use with Option 30

54112/163 Hard Transit case

54431/023 20 dB AF attenuator (BNC)

46884/728 Rack Mounting Kit

54421/001 BNC Telescopic Antenna

46884/650 Serial port to PC control cable (9 way)

46884/649 Serial port to PC control cable (25 way)

46884/648 RS-232 Printer cable (25 way)

59999/170 RF Directional Bridge

54421/002 (1 to 50 MHz) RF Directional Power Head

54421/003 (25 to 1000 MHz) RF Directional Power Head

54432/012 (100 Hz to 500 MHz) Wideband Amplifier

46880/079 Service Manual

† Options 4 and 5 cannot be fitted together.

† Options 23 and 24 cannot be fitted together.

‡ Battery Pack for previous model 2946 is still available under code 43113/018.

<sup>(1)</sup> At low modulation levels the residual AM/FM may become significant.